

Interactive comment on “The CHRONOS mission: Capability for sub-hourly synoptic observations of carbon monoxide and methane to quantify emissions and transport of air pollution” by David P. Edwards et al.

Anonymous Referee #1

Received and published: 27 July 2017

<General Comments>

CO₂ and CH₄ monitoring with gas filter correlation technology from GEO is very important mission from both global warming and air quality monitoring points of view. Observation needs are well described. Recently many GEO and LEO GHG monitoring programs have been proposed. The authors should describe difference from the Geo-CARB program using grating spectrometer technology. CHRONOS has advantage to measure both solar reflected light from surface and thermal radiation from middle of the troposphere. However, it is not clear gas filter correlation technique is more accu-

C1

rate and/or precise than other technique such as grating spectrometer and FTS in CH₄ retrieval. How to achieve 1% accuracy in CH₄ retrieval under aerosol and high thin cloud condition without light path modification information should be described in more detail. Authors mention single case of aerosol but thin cloud such as high altitude cirrus is not discussed. Authors proposed use of GOES satellite data for cloud detection but aerosol and thin clouds are difficult to filter out. Major revision is needed.

<Specific Comments>

(1) Plumes Page 5, Fig 1 Description of diurnal variation of CO emission and typical wind speed in WRF-Chem will help readers' understanding Page 10, Fig. 3 Description of CH₄ emission source in Greeley, CO will help readers' understanding.

(2) Page 7, Line 162, “ $\lambda_{ij6} - 12\%$ ” It is not clear. Does it mean between 6 and 12%?

(3) Page 10, Line 242, “Air quality criteria to protect public health” Reference or explanation is needed.

(4) Page 12, Line 298 The brief description of the reason why $5\mu\text{rad}$ is needed.

(5) Page 13, Line 313, “the effect of variations in the underlying surface” Does it mean fine spectral structure of surface albedo?

(6) Page 15, Figure 6, “solid red lines at filter half-power point” Is it 50% transmittance point? The transmittance at red line looks about 40%.

(7) Page 16, Line 366 (<10%) Accuracy requirement for CO and CH₄ must be different but instrument is similar. CO accuracy of 10% is reasonable and was demonstrated with MOPIT. How is the accuracy of 1% achieved in the CH₄ retrieval? Aerosol and thin cloud cause bias error and averaging cannot reduce the bias. Recent CH₄ satellite retrieval such as GOSAT use O₂A band in 0.76 micron to estimate light path modification by aerosol and CH₄.

(8) Page 17, Lines 375-333, “there 3 minute retrieval” “These 3 minute retrieval” and

C2

relation between 3 min intervals and retrievals are not clear. What is the definition of “single (10 min) data”?

(9) Page 21, Line 455, “all digital” What do the authors mean by “all digital”? Usually detectors and readout electronics have analogue portion such as amplifier and analogue to digital converter.

(10) Page 22, Line 487, “radiance calibration” Brief description of radiance calibration is needed.

(11) Page 23, Figure 11, vertical axis “#obs in domain/# pixels Explanation is needed.

(12) Page 30, Line 639, “launch in 2017” Page 32 table 3 OCO-3 (2017-) I think GOSAT-2 launch is scheduled to be in 2018 as the authors indicated in Table 3. I think OCO-3 has less possibility to be launched this year.

<Technical Corrections>

(1) Page 24, Line 522, “total hydrometeors > 10⁻⁸/kg/kg” Is it 10⁻⁸?

(2) Page 34, Line 723, “et al.” and many others. AMT authors guideline says “Please supply the full author list with last name followed by initials.” Other formats also do not meet the guideline.

Interactive comment on Atmos. Meas. Tech. Discuss., doi:10.5194/amt-2017-194, 2017.